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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

HIROKAZU IWATA

Serial No.: 09/746,600

Filed: December 21, 2000

For: HIGH FREQUENCY PIEZOELECTRIC
RESONATOR HAVING REDUCED
SPURIOUS MODES (As Amended)

Art Unit: 2834

Examiner: J. Gonzalez

AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

In response to the Office Action dated June 21, 2001, please amend the above-identified application as follows:

IN THE SPECIFICATION:

Please replace the paragraph extending from page 11, line 16 through page 12, line 2 with the following rewritten paragraph:

--Figs. 1(a) and 1(b) are views illustrating the construction of an AT cut high frequency crystal resonator according to the invention, and Fig. 1(a) being a plan view thereof and Fig. 1(b) being a sectional view taken along a line Q-Q. On a flat-surface side of a crystal plate 1 the other surface of that has formed therein a recess, there is disposed a main electrode (an excitation electrode) 2. From the electrode 2 there is extended toward an edge of the crystal plate 1 a lead electrode 3. Further, a second electrode 5 is so provided as to surround the peripheral edge of the main electrode 2 with a gap 4 in between. The size of the electrode 5 is made substantially the same as that of the recess 6 formed in the crystal plate 1. And, on a recess side there is formed an entire electrode (an excitation electrode) 7.--

Please replace the last paragraph bridging pages 13 and 14 with the following rewritten paragraph:

--Setting the center of the main electrode 2 to be the origin (0) and the dimensions of the respective electrode portions to be as stated previously as illustrated in Fig. 1(b) and assuming that the crystal plate 1 be an isotropic elastic body, one dimensional analyses of the thickness shear mode were performed. In the Japanese Patent Application Laid-Open No. Hei-9-27729 that is previously cited, analysis is made using the frequency equation that has been established under the assumption that the edge of the substrate be a free edge. However, in the case of a resonator wherein the periphery of the vibration portion is retained by the annular surrounding portion as in the invention, the frequency equation should be established under the assumption that the edge of the vibration portion be a fixed edge. Accordingly, the frequency equation is as follows.--

Please replace the last paragraph on page 18 with the following rewritten paragraph:

--Fig. 5 is a plan view illustrating the main electrode and second electrode constituting a main part of the piezoelectric resonator according to a third embodiment of the present invention. The difference of Fig. 5 from Fig. 1 is that an elliptic main electrode (an excitation electrode) 2a is disposed as the main electrode (excitation electrode) 2 illustrated in Fig. 1(a). This difference further resides in that an elliptic groove hole is formed in the central part of the plate so as to surround the peripheral edge of the main electrode 2a with a gap. That difference further resides in that a second electrode 5a substantially corresponding to the recess 6 of the crystal plate 1 is disposed around the main electrode 2a with the elliptic groove hole in between. That an entire electrode is disposed over the recess of the crystal plate is the same as in Fig. 1.--

Please replace the first full paragraph on page 19 with the following rewritten paragraph:

--The reason for having made the main electrode 2a elliptic is as follows. Determining the two-dimensional vibration displacement distribution of the main vibration, as an attempt, by applying a finite element method, it is seen that the displacement distribution of the main vibration is elliptical due to the anisotropy of the crystallographic axis of the crystal plate. Therefore, manufacturing a high frequency resonator wherein the main electrode is formed elliptic in conformity with the displacement distribution of the main vibration and the second